

様式 F - 7 - 1

科学研究費助成事業（学術研究助成基金助成金）実施状況報告書（研究実施状況報告書）（平成29年度）

所属研究機関名称		奈良先端科学技術大学院大学	機関番号	14603
研究 代表者	部局	情報科学研究科		
	職	助教		
	氏名	Plopski Alex		

1. 研究種目名 若手研究(B) 2. 課題番号 17K12726

3. 研究課題名 Gaze understanding in Optical-see-through Head-mounted Displays

4. 補助事業期間 平成29年度～平成30年度

5. 研究実績の概要

According to our plans for 2017, we developed a system for estimating the user's focus depth. The system records the user's gaze at different distances and regresses the depth gaze with a multi-layer perceptron neural network. We tested the system on 12 participants and found that we could accurately determine when the user is focused at the separate planes, however we still have significant estimation errors at unknown depths.

We developed a method for realistic rendering of virtual content on an optical see-through head-mounted display (OST-HMD) based on the user's focus depth. Our results show that we can fool participants into believing that the virtual object is real in some cases, this does not succeed in others.

We also studied how users perceive virtual content when they focus at objects located at a different distance. By sharpening the presented content we expected users to be able to better recognize the virtual content. Our results indicate that while sharpening indeed improved readability, the amount of sharpening varied between participants.

Finally, we evaluated if it is possible to increase the perceived brightness of virtual objects, without noticeably dimming the brightness of the real world. We gradually adjusted the transmission of shutter glasses over a period of time, thus reducing the amount of incoming light. Our results show that gradual dimming indeed increases the perceived brightness of the virtual content without significantly affecting the perceived brightness of the real world.

6. キーワード

ウェアラブル機器

7. 現在までの進捗状況

区分 (2) おおむね順調に進展している。

理由
According to our plan, we have developed an HMD capable of eye-gaze tracking. We also investigated how to estimate the depth the user is focusing on. We are currently still investigating different calibration algorithms, but have already applied the depth estimation to algorithms that modify the virtual content according to the estimated focus depth.
We published 1 journal, 3 conference papers, and 1 poster paper with the results of this project.

2 版

8. 今後の研究の推進方策

In 2018, we continue mostly according to our previous plans. We will focus on evaluation the gaze calibration accuracy of eye-gaze in augmented reality scenarios. We will compare the calibration results when real and virtual targets are used for the calibration process and explore how this process can assist estimating the user's focus depth. We will combine the eye-tracker with the autorefractometer available at our laboratory to provide an independent benchmark that can be used to compare different calibration and gaze-depth estimation methods. Finally, we will focus on the development of novel interaction metaphors and interfaces that take advantage of the available information. Furthermore, we want to investigate how eye-gaze tracking can be used for automatic calibration of an optical see-through head-mounted display.

9. 次年度使用が生じた理由と使用計画

I was conducting research in the USA for 3 months. During this time, I could make use of the local facilities and did not need to hire an RA during this time. I plan to purchase additional equipment and use the remaining budget for experiments during 2018. Our research progressed according to the original plan, thus it is not an issue that some budget remained for the second year.

10. 研究発表（平成29年度の研究成果）

〔雑誌論文〕 計1件（うち査読付論文 1件/うち国際共著 1件/うちオープンアクセス 1件）

1. 著者名 Rompapas Damien, Rovira Aitor, Plopski Alexander, Sandor Christian, Taketomi Takafumi, Yamamoto Goshiro, Kato Hirokazu, Ikeda Sei	4. 巻 1
2. 論文標題 EyeAR: Refocusable Augmented Reality Content through Eye Measurements	5. 発行年 2017年
3. 雑誌名 Multimodal Technologies and Interaction	6. 最初と最後の頁 22:1 ~ 22:18
掲載論文のDOI（デジタルオブジェクト識別子） 10.3390/mti1040022	査読の有無 有
オープンアクセス オープンアクセスとしている（また、その予定である）	国際共著 該当する

〔学会発表〕 計4件（うち招待講演 0件/うち国際学会 4件）

1. 発表者名 Youngho Lee, Choonsung Shin, Alexander Plopski, Yuta Itoh, Thammathip Piumsombon, Arindam Dey, Gun Lee, Seungwon Kim, Mark Billinghurst
2. 発表標題 Estimating Gaze Depth using Multi-Layer Perceptron
3. 学会等名 International Symposium on Ubiquitous Virtual Reality（国際学会）
4. 発表年 2017年

1. 発表者名 Shohei Mori、Sei Ikeda、Christian Sandor、Alexander Plopski
2. 発表標題 BrightView: Increasing Perceived Brightness in Optical See-Through Head-Mounted Displays
3. 学会等名 IEEE International Symposium on Mixed and Augmented Reality (国際学会)
4. 発表年 2017年

1. 発表者名 Shohei Mori、Sei Ikeda、Alexander Plopski、Christian Sandor
2. 発表標題 BrightView: Increasing Perceived Brightness of Optical See-Through Head-Mounted Displays through Unnoticeable Incident Light Reduction
3. 学会等名 IEEE International Conference on Virtual Reality (国際学会)
4. 発表年 2018年

1. 発表者名 Trey Cook、Nate Phillips、Kristen Massey、Alexander Plopski、Christian Sandor、J. Edward Swan II
2. 発表標題 User Preference for SharpView-Enhanced Virtual Text during Non-Fixated Viewing
3. 学会等名 IEEE International Conference on Virtual Reality (国際学会)
4. 発表年 2018年

〔図書〕 計0件

1 1. 研究成果による産業財産権の出願・取得状況

計0件（うち出願0件 / うち取得0件）

1 2. 科研費を使用して開催した国際研究集会

計0件

2 版

1 3 . 本研究に関連して実施した国際共同研究の実施状況

共同研究相手国	相手方研究機関			
USA	Mississippi State University	Johns Hopkins University	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-				

1 4 . 備考

-